Myank Singhal

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About Me

Computational Astrophysicist specializing in N-body simulations, relativistic dynamics, and machine learning applications in astronomy. Expertise in theoretical modeling and observational data analysis, with a publication record in galactic dynamics and stellar systems.

Education

Charles University, Prague

PhD in Astrophysics *Mar. 2022 - Present*

- Supervisors: **Dr.Ladislav Šubr**
- **Evolution of systems in Galactic Nucleus with N body simulations**: This research project involves studying N-body systems to understand evolution of systems in galactic centers, focusing on the Milky Way's Galactic Center.

University of Bristol, UK

M.Sc. in Physics by Research *Sep. 2020 - Dec 2021*

- Supervisors: **Dr. Sotiria Fotopolou & Prof Malcolm Bremer**
- **Star-Galaxy classification with a novel neural network architecture**: This research project involved using machine learning algorithms and SED fitting to classify stars from galaxies using broadband photometry. The machine learning algorithm was designed to account for uncertainty and missing photometry.
- Thesis titled "**Star-Galaxy classification with a novel neural network architecture**" is available online.

University of California, Los Angeles, USA *Upper Div GPA: 3.858*

B.Sc. in Astrophysics *Sep. 2016 - Dec. 2019*

- Department Highest Honors in Astrophysics
- **Dean's Honors List**: Fall 2016, Spring 2017, Spring 2018, Fall 2018, Spring 2019

Research Experience

Dynamical Coupling of Keplerian Orbits in Relativistic Gravity *Charles University*

PhD Candidate *Feb 2022 - May 2024*

- Worked on an analytic expression to describe evolution of Keplerian orbits in relativistic gravity around massive bodies when perturbed by a distant perturber.
- Performed both few body simulations and N-body simulations to showcase various modes of the coupling.
- Provides theoretical predictions for survival of large scale disk-like structures in the Galactic Center.

Star Galaxy classification using ML with Dr. Sotiria Fotopoulou and Prof. Malcolm Bremer *University of Bristol*

Masters by Research Student *Sep. 2020 - Dec 2021*

- Developed a neural network architecture called StarMAP that can stars from galaxies with missing and augmented photometry with high classification accuracy.
- The work also explored incorporating observational uncertainty in the machine learning models to get better predictions.
- The work is aimed to accurately classify objects with Euclid like photometric bands and importance of WISE filters is also discussed.

Light Curve Analysis for RR Lyrae Variable Stars with Prof. Harinder P. Singh *Delhi University*

Research Assistant *Dec. 2019 - Aug 2020*

- Worked on 274 theoretically generated light curves of RR Lyrae variable stars obtained from Marconi et al.(2015).
- Made a Sequential Neural Network program to interpolate light curves in the I-band for values of the 6 input parameters (Mass, Luminosity, Periodicity, Temperature and Stellar Composition [X,Z]) not in the generated set.
- Compared interpolated light curves with empirical light curves to find properties of the RR Lyrae Variable Stars.

Stellar Radio Data Analysis for SETI with Prof. Jean-Luc Margot *UCLA*

Research Assistant *Apr. 2018 - Jun. 2019*

- Analyzed the radio data of 17 G5 stars in the Milky Way for extra-terrestrial radio signals from planets near these stars.
- Worked on a Graphical User Interface (GUI) to label the data-set in an user friendly way for a future citizen science project.
- Designed a Neural Network to identify the earth-bound satellites from the complete data-set of more than 800,000 signals.

Publications

- Jaroslav Haas, Pavel Kroupa, Ladislav Šubr and Myank Singhal (2025),**The star grinder in the Galactic centre - Uncovering the highly compact central stellar-mass black hole cluster** Astronomy & Astrophysics, 695 (2025) L19

- Florian Peißker, Michal Zajaček ... Myank Singhal et. al. (2024),**Candidate young stellar objects in the S-cluster: Kinematic analysis of a subpopulation of the low-mass G objects close to Sgr A*** Astronomy & Astrophysics, 686 (2024) A235
- Myank Singhal, Ladislav Subr, Jaroslav Haas (2024) **Dynamical coupling of Keplerian orbits in a hierarchical four-body system: from the Galactic Centre to compact planetary systems** Monthly Notices of the Royal Astronomical Society, Volume 531, Issue 1, June 2024, Pages 2028–2039
- Jean-Luc Margot, Pavlo Pinchuk ... Myank Singhal et. al. (2021) **A Search for Technosignatures Around 31 Sun-like Stars with the Green Bank Telescope at 1.15–1.73 GHz** Astronomical Journal 161 55

Conferences

- Poster at Modest 24 in Warsaw, Poland (19-23 August 2024) titled "Evolution of Disk-like Structures in the Galactic Centre."
- Invited talk at 17th Marcel Grossmann Meeting in Pescara, Italy (7th-12th July 2024) titled "Dynamical Coupling of Keplerian Orbits in Post Newtonian Gravity: From Galactic Center to Compact Planetary Systems."
- Talk at Galactic Nuclei in the Cosmological Context in Szczecin, Poland (3-6 June 2024) titled "Evolution of Disk-like Structures in the Galactic Centre."
- Poster at Two in a Billion in ESO Garching, (11-15 September 2023) titled "Compact Object Interactions in Star Clusters: Implications for GW Noise."
- Talk at Bezovec 2023 in Bezovec, Slovak Republic (16-18 June 2023) titled "On the coherent evolution of stellar structures in the Galactic Centre."
- Poster at Galactic Center Workshop in Granda, Spain (24-28 April 2023) titled "On the coherent evolution of young stellar disc in the Galactic Centre."

Honors & Awards

2023- 2026	**Research Grant**, Grant Agency of Charles University	*Czech Republic*
2024	**Mobility Fund**, Research visit to Köln University, by Charles University	*Czech Republic*
2024	**Mobility Grant**, Research visit to Köln University, by Köln University	*Germany*
2023	**Mobility Grant**, Research visit to Köln University, by Charles University	*Czech Republic*
2019	**Department Highest Honors in Astrophysics**, University of California, Los Angeles	*U.S.A*
Spring 2019	**Deans Honor List**, University of California, Los Angeles	*U.S.A*
Fall 2018	**Deans Honor List**, University of California, Los Angeles	*U.S.A*
Spring 2018	**Deans Honor List**, University of California, Los Angeles	*U.S.A*
2018	**Best Gaming Hack Award**, LA Hacks	*U.S.A*
Spring 2017	**Deans Honor List**, University of California, Los Angeles	*U.S.A*
Fall 2016	**Deans Honor List**, University of California, Los Angeles	*U.S.A*

Outreach

Astronomy on Tap — *Prague*

Science Outreach — *2025*

- Organized monthly astronomy focused public outreach events.
- These events had two talks given by PhD students or staff members. We also organized pub quizzes with prizes funded by ESO.

Astronomy on Tap — *Köln*

Talk — *14 November 2024*

- Presented a talk to a general audience on the galactic center of Milky Way galaxy.
- The talk focused on how the observation of the Galactic Center provides us evidence for the theory of general relativity.

Aerospace Bristol — *Bristol*

Talk — *12 July 2021*

- Presented a talk to year 9 - 11 students and introduce them to astrophysics research.
- The talk titled "*Using Machine Learning to Classify Stars*" is available online on YouTube

Science Lab Teaching Club — *UCLA*

Science Outreach Member & Treasurer in 2019 — *Sep. 2016 - December 2019*

- Taught energy, fundamental forces, relativity, space-time, and non-newtonian fluids using interactive demonstrations to spark interest in elementary school students.
- Set up and demonstrated practical experiments on electromagnetic forces and induction at Explore Your Universe Fair held at UCLA in 2018 and 2019.
- Taught middle school kids about the Bohr atomic model and transitions at the Martin Luther King Junior Fair held at UCLA.
- Managed the funds of the club and ordered supplies for various presentations.

Additional Technical Projects

- **Collision Detecting Autonomous Drone:** Designed and 3D-printed an autonomous drone with a YOLO neural network for real-time collision detection and Ardupilot for way-point navigation.

- **FearMe (Best Gaming Hack, LA Hacks 2018)** Developed a Unity-based horror game adapting to user emotions detected via a Muse headband. Created a neural network to classify brainwave data for real-time gameplay adjustment.
- **Food Recognition on Mobile:** Built an iOS app to identify food items using a retrained Inception v2 neural network, displaying nutritional data via the USDA NDB API.
- **Raffle Master:** Digitized raffle management with a QR code-enabled iOS app, leveraging Amazon AWS for secure user data storage and winner selection.

Specialized Skills

- **Astrophysics Focused Computer Skills:** Nbody6/Nbody7, Python (Tensorflow, Numpy, Scipy, Pandas, Plotly, Astropy), C++, Fortran, High Performance Parallel Computing (OpenCL, MPI, OpenMP), LaTeX.
- **General Computer Skills:** Java, SQL, Swift, Octave, Mathematica, Linux and Git.
- **Lab Skills:** Soldering, Circuit electronics and Microprocessors